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New sprayer technology: what farmers need to know

Today's leading edge sprayer technology puts the power in producers' hands – but they'll have to understand it to get full value.

For about 30 years, spraying was most often a three week operation. With a pull-type rig, farmers covered crops with post-emergence products and then forgot about spraying for the rest of the year.

These days, spraying is considerably more complex. Today's 90 to 120 foot sprayers, valued at $300,000 offer high clearance, with auto rate control and GPS technology. Many sprayers are used for six months of the year, in pre-emergence, post-emergence, pre-harvest and post-harvest treatments.

With a complicated range of options and systems, it's no wonder producers are rethinking sprayer application technology and systems.

Keeping pace with sprayer evolution

Sprayer technology has been a specialty at the AgTech Centre in Lethbridge, Alberta, since it was first established in 1975. In the last 25 years, the Centre has overseen the design, development and testing of new sprayer technology and has witnessed first-hand the dramatic evolution of today's high-tech equipment.

Perhaps no one has had more direct sprayer experience than Project Manager, Brian Storozynsky. A veteran of the AgTech Centre (he helped pour the concrete when the facilities were built in their present location near the Lethbridge Community College), Storozynsky has watched sprayers evolve from those first pull-type rigs.

The secret of getting the most value from sprayer technology today, says Storozynsky, is to understand the history of sprayer technology, why the designs developed and why they led to future changes. That development path helps explain many of the questions that producers are asking about sprayers. ✦

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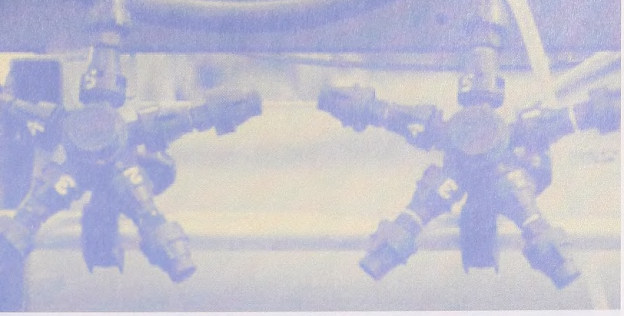


THE SPRAYER REVOLUTION: 1975-2000

The big developments in sprayers and how they led to today's high-tech design

As recently as 1975, controlling spray variables was essentially a manual task. "This was fairly simple because tractor speed was limited to a fairly constant 5 miles per hour (mph)," says Storozynsky. Recommended spraying pressure was 40 psi, and the key to avoiding drift was to avoid spraying in winds above 6 mph and using 10 gallons per acre (gpa) nozzles (e.g. 8002 nozzles). Around 1980, that put drift loss below three percent, a fairly reasonable margin of loss for the time. For today's farmers using conventional nozzles, this advice still applies.

The demand for more flexible spray systems emerged when advances in machinery allowed farmers to vary tractor speed, says Storozynsky.

Auto-rate controllers reduced error, enhanced flexibility

Auto-rate controllers, introduced about 20 years ago, took a lot of the guesswork out of spraying and allowed greater flexibility for farmers, says Storozynsky. An auto-rate control feature monitors and measures water flow and tractor speed to automatically keep the application rate constant.

"This technology reduced the chance of error. Farmers no longer had to sit on a tractor or a self propelled sprayer and adjust pressure – with auto-rate control, it was done automatically. Basically, if you wanted to apply 5 gpa, you entered the number, and it automatically delivered that for you, no matter what the speed.

"Some small farmers still do without auto rate controls because they really don't need it," he says. "For the farmers still going 5 mph, their speed doesn't change all that much when they're spraying. With high clearance rigs and truck mounts going anywhere from 10 to 20 mph, their speed is always changing. When they're going that fast, they can't really control the pressure anymore. For them, auto-rate control reduces a lot of error."

However, despite its dramatic benefits for the industry, auto-rate control created another problem – inadequate coverage.

Wide-angle nozzles provide better coverage (1985)

Wide-angle nozzles, introduced in 1985, allowed producers to keep the coverage uniform across the length of the boom no matter what the speed, especially with the extended range 110 degree nozzles, Storozynsky says. "With auto rate controllers, the older tips didn't have enough angle to cover between the nozzles. With the 65 and 80 degree tips, when you slowed down and your pressure went from 40 to 20 psi, there was inadequate coverage and misses in the field. As spray angles widened, coverage improved, making the automatic rate controller more suitable.

"With wide-angle nozzles, farmers with modern rigs with auto rate control can slow down and speed up as much as they want, because the nozzles are designed for coverage from 15 to 100 psi," he says.

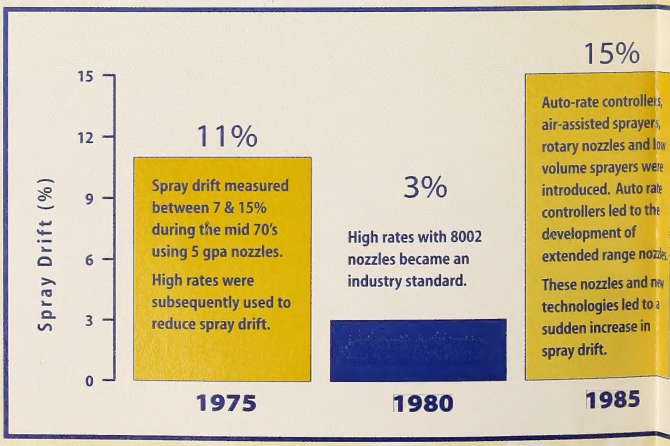
Although increased nozzle angle allowed greater coverage at slow speeds, it created yet another challenge – increased drift, often as high as 15 percent. Also during this time, there was a trend towards using smaller droplets as air-assisted sprayers, rotary nozzles and electrostatic sprays were introduced. Manufacturers of these spraying systems claimed smaller droplets were more effective because of better coverage and under-leaf coverage.

"All of a sudden we were drifting five times more than we were five years before," says Storozynsky. "Since then, we've been trying to get our drift levels back down to three percent, to what they were in 1980. And it's taken industry 20 years to do that, starting with shrouds, then low drift and finally venturi nozzles."

Shrouds introduced to control drift (1988-1995)

To address drift, some manufacturers introduced a shroud device to cover the nozzle and its spray. From the nozzle tip to ground level, a plastic shield fitted in the front or the rear of the sprayer, prevented the spray from drifting.

"Shrouds were really popular from about 1988-1995," says Storozynsky. "The problem was, most farmers found them a nuisance. Farmers couldn't see the spray, so they didn't know



if the nozzles were plugging. They also had to wash the shroud when switching chemicals. Chemicals clinging to the shroud could damage the next crop, and a lot of farmers didn't like that."

Addressing drift

"At the AgTech Centre, ever since we started testing nozzles using a wind tunnel, we've seen a dramatic improvement in sprayer tips," says Storozynsky. "From our wind tunnel studies of the past 10 years, we found that, no matter what type of nozzles we test, or their size or pressure, the material that drifts is always the same size in terms of the droplets that float in the air. Those droplets are almost always less than 150 microns in diameter.

"After this information was released, the nozzle manufacturers set out to get rid of the 150 micron droplets. And that's what's happened with the low-drift nozzles and the venturi nozzles – they eliminated droplets less than 150 microns, which is why we get less drift now."

The venturi nozzle works by passing spray solution through a tapered passage in the nozzle. As the passage diameter decreases, the spray is accelerated. At the tapered passage outlet, this acceleration creates a natural vacuum causing air to be sucked from outside the nozzle tip through one or two holes. The spray solution and air are mixed in the chamber before exiting the nozzle tip. The compression in the mixing chamber causes air bubbles to be formed inside the liquid spray droplets.

This nozzle design produces larger spray droplets, which has a positive effect on spray drift, and a reduced number of droplets per plant with little compromise in application uniformity or chemical efficacy. As an added advantage for farmers, the venturi nozzle tip fits into existing nozzle caps, says Storozynsky.

Venturi nozzles have rapidly become popular with producers because drift levels are reduced down to 3 percent, back to what they were 20 years ago, says Storozynsky. "Some venturi nozzles are more effective than a shroud, in terms of reducing drift, and now you don't have a shroud to wash when you're switching crops and chemicals. With the sprayer visible again, farmers can see the spray again, which they seem to like, to detect which nozzles are plugging."

"At AgTech Centre, we have divided all of the venturi nozzles into two categories: high pressure venturis, and low

pressure venturis," Storozynsky says. Low pressure venturis can be used the same way as conventional tips with the average spraying pressure set at 40 psi. Storozynsky recommends low-pressure venturis for farmers who have always used conventional tips and want assurance of efficacy. Low pressure venturi nozzles can also be used on high clearance sprayers, even though high pressure venturis are often the better option.

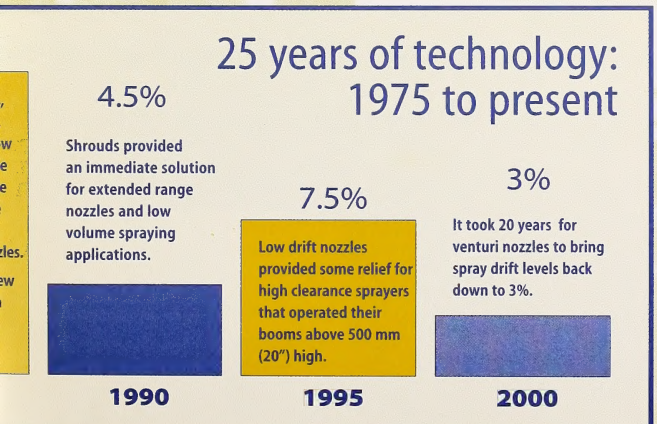
Information for Western farmers

AgTech Centre has extensive reports on a wide range of equipment. Questions or comments and copies of reports are available to farmers across Western Canada by contacting the Centre directly.

"We're recommending the high pressure venturis for the high clearance sprayers – those big 200 hp machines. High pressure venturis reduce drift up to 90 percent, depending on nozzle type, size and pressure. High pressure venturis should be operated above 70 to 80 psi to get adequate coverage in small and grassy-type weeds." Until all the results are in, high pressures are recommended for all venturi nozzles with some chemicals used to control weeds at the cotyledon stage.

Producers should remember to carefully calculate their application rates when using pressures other than 40 psi with venturi nozzles, Storozynsky cautions. "Twenty years ago, everybody sprayed at 40 psi, in part to reduce drift. Now, with venturi nozzles, we are spraying from 40 to 120 psi. With venturis, high pressure now does not necessarily mean more drift, which was the case with conventional and extended range nozzles." ✦

25 years of technology: 1975 to present



SPRAYER TECHNOLOGY FOR TODAY AND TOMORROW

Answers to some common questions

Investigations underway at the AgTech Centre, as well as at other institutions across North America and around the world, continue to improve sprayer technology and address producer concerns along the way.

Shroud/venturi combination

Producers are wondering what to do with the shrouds now that they've switched to venturi nozzles, says Storozynsky. "A lot of farmers are taking the shrouds off and using the low drift and the venturi tips to reduce drift," he says. "However, if farmers don't mind putting up with the hassle, we think the combination of a shroud and a venturi tip could basically eliminate drift." Storozynsky and colleagues at the AgTech Centre are investigating the potential of this combination and information will soon be available to producers.

GPS technology to replace foam markers

For harvest, Global Positioning Systems (GPS) are the number one tool right now, says Storozynsky. However, GPS is not yet as popular for spraying because the technology is still being fine-tuned. "Today, GPS is seen mainly on custom sprayers, although some farmers are slowly getting into it," says Storozynsky. "It has the potential to be a powerful tool as a field guide to show where and how much of the field has been sprayed. The technology is just getting accurate enough to be useful."

Foam markers are still a viable alternative to GPS, says Storozynsky. "Although there are several makes and models, years of testing sprayer foam markers show there are only two types. Premixed models and models where the foam concentrate and water need to be added and mixed." Performance of foam markers within the two types is similar, but foam quality and durability are different, he says.

With foam markers requiring mixing, the foam lasts up to two hours in cool and cloudy conditions, but less than 10 minutes in hot, dry conditions, he explains. "The foam is dispensed randomly, although some control in mark size and intervals are possible with some models. Relatively economical, these foam markers cost only about five to ten cents per acre."

Premixed foam markers are simple in construction and foam quality is consistent, lasting up to two hours in hot weather and more than eight hours in cool weather. "The size of a mark and marking interval is controlled precisely. The cost of premixed foam markers varies from 20 to 50 cents an acre, depending on mark settings."

With both types of foam markers, soil and canopy temperatures determine how long the foam will last, Storozynsky explains. Soil temperatures above 40 C, makes the foam disappear rapidly.

The rate debate: AgTech investigates #1 farmer question

How much to reduce chemical rates is the question that Storozynsky is asked again and again by farmers. New research underway at the Centre may soon supply some answers.

Unfortunately, for now there are no easy answers. "Reducing rates is the number one question because farmers see that as one of the few ways they can make a buck these days."

The challenge is that the question forces Storozynsky to favour either the chemical label rates determined by the chemical companies, or new technology such as the air assisted and electrostatic sprayers that promise to reduce chemical rates. "There are no easy answers to the debate," he says.

Farmers are doing their homework

In 1975, farmers had to keep only four numbers in mind – 8002, 5, 40 and 10 – an 8002 nozzle, going 5 mph, with spray pressure at 40 psi, to put on 10 gpa.

"This is what farmers have lived by for 30 years," says Storozynsky. "Now we're telling them to be more flexible. They're faced with different sprayers, nozzles, pressures and different rates." Many of Storozynsky's calls are from farmers trying to decipher all of the information being thrown at them. "Most farmers are doing their homework, and it's essential they continue. Staying up-to-date and calculating application rates accurately are key to getting full value from today's sprayer technology," he emphasizes.

"I think a lot of farmers have done their homework and they know what they're doing. When they call, they just want confirmation and assurance," he says. ✦

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